Teacher's Guide: Graphing Distance and Time: Travel

Recommended Grade Level: 5–8
(also applicable to grades 9–12 for students requiring significant support in learning)

Suggested Time: About 50–60 minutes spread over one or more class periods, plus additional time to complete a writing assignment

Goals

Following are the big ideas that students should take away after completing this lesson:

- Distance and time can be represented on a graph.
- The steepness of a line segment on a distance–time graph can tell you how quickly an object was traveling during a certain period.

Vocabulary

(See definitions on page 6.)

- axis
- graph
- horizontal
- origin
- steepness
- vertical

Key Literacy Strategies

Following are the primary literacy strategies students will use to complete this activity:

- Making inferences (screens 5 and 6)
- Determining important information (screens 7 and 8; writing assignment 3)
- Identifying and using text features (screens 10 and 12; writing assignments 2 and 3)
- Constructing summaries (final assignment 1)

Note: In addition to the key literacy strategies listed above, students will also use each of these strategies to complete this lesson:

- Monitoring comprehension
- Synthesizing
- Making predictions
- Developing vocabulary
- Connecting prior knowledge to new learning
- Developing a topic in writing
- Identifying and using text features (photographs, captions, diagrams, and/or maps)

Overview

Graphing Distance and Time: Travel is a student-directed learning experience. However, while students are expected to work through the lesson on their own, teachers should be available to keep the lesson on track, organize groupings, facilitate discussions, answer questions, and ensure that students meet all learning goals.

The following is a summary of the lesson screens:

Screen 1: Students think about the difference between mapping distance and time.

Screen 2: Students are introduced to the concept of mapping distance over time as they think about a brother and sister's bicycle trip.

Screen 3: Students learn what the goals are for the lesson, which strategies they will be using to complete the lesson, and the important vocabulary words they will use during the lesson.

Screen 4: Students learn to identify the parts of a graph, including the axes and origin. Then they learn how to read a distance–time graph. They consider that a single point on the graph can show where a moving object is at a certain moment.

Screen 5: Students watch a video of Harry, a unicyclist, who is planning a trip to his grandmother's house. He creates a distance–time graph to estimate where he will be after 1, 2, 3, and 4 hours. Students write about whether they think Harry's unicycle trip will go as smoothly as planned.

Screen 6: Students watch the next section of the unicycle video, which shows the beginning of Harry's trip. The difference between predicted and actual travel is explored. Students also consider the idea of a line's *steepness* as it relates to speed. They then write about whether they think Harry will arrive ahead of or behind schedule.

Screen 7: In the next part of the video, Harry goes much more slowly. Students look at how the steepness of the graph changes when he slows down and then write about what steepness means in the context of a distance–time graph.

Screen 8: Students watch the final part of the video, in which Harry reaches his destination. Then they compare the predicted and actual journeys as represented on the distance–time graph. To demonstrate their understanding of what the graphs show, students describe Harry's entire trip, referencing the data on the distance–time graph.

Screen 9: Students answer three multiple-choice questions that assess their understanding of distance–time graphs.

Screen 10: Students read a passage about three people competing in a triathlon. After considering their progress as mapped on a distance–time graph, students write about the section of the triathlon in which the competitors were traveling the fastest.

Screen 11: Students complete an interactive vocabulary activity, and then choose two words from the vocabulary list and write a new sentence for each word. These tasks demonstrate their understanding of the meanings of the words.

Screen 12: Students use an interactive activity to place events onto a distance–time graph.

Final Assignment: Students select and complete a writing assignment about the lesson topic.

Before the Lesson

- ❑ Go through each screen of the lesson, including all the interactive activities, so that you can experience ahead of time what students will be doing. As you go through each screen, jot down your own expectations for students' responses.
- ❑ Determine if students will be working individually or in pairs on the lesson. Some students may be able to work independently with little or no support. Students who are less familiar with the subject area or who struggle with literacy skills may benefit from working with another student. An effective way to do this is to pair a stronger student with a less able reader. You can also have students work individually on certain tasks and in pairs on others, depending on their experience and needs. If students will be working in pairs on any portion of the lesson, let them know if they will be expected to type in their notes individually or together.
- ❑ Provide instruction on key vocabulary (vocabulary words are defined in the lesson on screen 3, and on page 6 of this guide).
- ❑ Determine what students already know about measuring distance, keeping time, and charting distance versus time on a graph. Record their ideas on a chart. You may want to structure the chart with these questions: "How does a map help you when you are going on a trip? When you go on a trip, what do you want to know besides how to get there? What is a graph? When might you use a graph?" This will give you a sense of the background knowledge and possible misconceptions that students have before beginning this lesson. If time allows, return to the chart after students have completed the lesson to add new learning and correct misconceptions. Note: You may want to record their new learning in a different-colored ink so they can see how much they've learned.
- ❑ Arrange computers with Internet access so students can work individually or in pairs.
- ❑ Before students begin, suggest a timeline for completing the lesson, mention the different types of media they will encounter, and let them know how you expect them to submit their work. You may want to provide an outline of this information on a chart, chalkboard, or whiteboard, or as a handout.

Lesson Assessments

The following are descriptions of the lesson features that will be part of the packet of materials that students will submit. Students will use the packet for reference when writing their final assignment. It also serves as a formative assessment tool to monitor students' work as they are progressing through the lesson.

- **Notes** – Students take notes on screens 5, 6, 7, 8, and 10. If time allows, review their notes before students begin their writing assignment.
- **Multiple-choice questions** – Students complete the three questions on screen 9. Walk around to make sure students answer all three questions before they continue. If students click to go to the next page before they finish, their work will not be saved.

- **Match It!** – Students complete an interactive vocabulary activity on screen 11. They begin by dragging the vocabulary terms into the correct sentences. After they finish and save their work, they will be able to check their answers against an answer key. When they are done, they will be asked to choose two vocabulary words and write a new sentence for each word. Sentences should demonstrate a clear understanding of the meaning of each word. An inappropriate response would be "The line went through the origin." An appropriate response would be "The graph of the trip began at the origin, where the two axes meet."
- **Arrange It!** – Students complete the concept map activity Arrange It! on screen 12. Students will see two trips charted on a distance–time graph: a typical trip and an actual trip. Students then use what they know about steepness and distance–time graphs to label different sections of the graph. Students will not be able to check their answers online, so you will need to provide them with correct answers when they are finished with the lesson. You can choose to review the answers as a class or return the corrected packet of materials to students before they begin the final assignment.
- **Final Assignment** – Students complete one final writing assignment. You can choose to let students make their own selection or assign one according to your goals for the lesson. Use the rubric on pages 7 and 8 to assess the writing assignments.

Lesson Aids and Extensions

Use the following suggestions to help students if they are stuck on a particular screen, to prepare students for completing their writing assignments, or as follow-up discussions to reinforce learning.

- **Watching Videos** – Encourage students to watch the videos more than once. After the initial viewing, provide students with a specific content focus to frame their next viewing(s) of the video. This will help them draw connections between the main topic and the information that the videos have to offer.
- **Participating in Discussions** – Organize class discussions or encourage students to talk about their questions in pairs. You may want to use the following discussion starters:
    - o What are some ways you can use a graph to show travel?
    - o Can the line on a distance–time graph ever go up and then down, like a pyramid? What do you think that would mean?
    - o What is a distance–time graph? How is it different from a road map?
    - o If Harry graphed his trip every 15 minutes instead of at 1, 2, 3, and 4 hours, do you think it would look any different?
- **Reading the PDF Text** – Before they read the PDF text on screen 10, ask students what they know about a triathlon. Tell them that a triathlon is a race that includes three different events—a swim, a bike race, and a run—and then ask them to predict what the distance–time graph of a triathlete's performance might look like. Then review the basic details of a distance–time graph and talk about the idea of steepness in these types of graphs. You may want to revisit these questions and issues after they read the passage to clarify any misconceptions.

- **Sharing Student Work** – It may be motivational, and a further learning opportunity, for students to post their final essays so that their classmates, peers, and/or parents can see them. This may also provide an opportunity for students to comment on and discuss each other's essays.

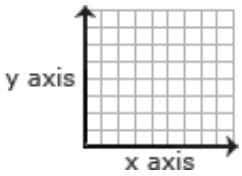
  If you do not already have access to an online writing community, Teaching Matters™ provides TeXT, free classroom publishing tools that allow teachers and students to create and publish their own online eZine. More information and a free signup are available at Teaching Matters: TeXT (http://text.teachingmatters.org).

- **Reflection and Self-Assessment** – After students have turned in their writing assignments, you can choose to have them assess their learning. Bring students together as a whole class or in small groups to discuss the questions below. You may want to return to the chart of their ideas developed before the lesson and record their new learning. You may also have students respond individually to the questions and then convene the class to discuss the chart.
  - o What did you learn?
  - o What was surprising?
  - o What questions do you still have?
  - o What was the easiest for you to understand and do?
  - o What was the most difficult?

Vocabulary Definitions

axis

A vertical or horizontal line that borders a graph. More than one axis is spelled *axes*.



graph

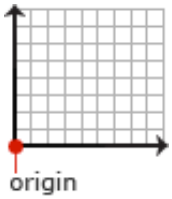
An image that displays data about a situation. In a *distance-time graph*, the distance is displayed on the vertical axis, and the time is displayed on the horizontal axis.

horizontal

Something that points left to right. A horizontal line is flat, like the horizon.

origin

The point on a graph where the horizontal and vertical axes meet.



steepness

A way of describing how vertical a line is. A steep line will be vertical, while a line that is not steep will be more horizontal, or flat.

vertical

Something that points up and down. A vertical line points to the sky and to the ground.

Final Assignment Rubric (page 1 of 2)
Graphing Distance and Time: Travel

1. Explain what you have learned about distance-time graphs. In your response, answer the following questions:
   - When do you use distance-time graphs?
   - What does the line on a distance-time graph show?
   - How do you make a distance-time graph?

   You may draw graphs to help explain your answer.

2. Write a story that goes along with the distance-time graph (refer to the graph in the final assignment document). In your story, make sure to include:
   1) who the character is;
   2) what the character wanted to do;
   3) what the character was doing during each section of the trip; and
   4) why the graph changes direction a couple of times.

4	3	2	1
Provides a clear and accurate response to the question. Ideas are elaborated, with three or more relevant supporting details from the reading passage, video, and other materials in the lesson.	Provides an adequate response to the question. Topic and ideas are generally well organized, with two relevant supporting details from the reading passage, video, and other materials in the lesson.	Provides a generally accurate response, with one supporting detail from the reading passage, video, and other materials in the lesson.	Provides an inaccurate response to the question or fails to address the question. May include misinterpretations. Understanding of the topic is not apparent.
Uses at least three vocabulary words (or a form of the vocabulary words) from the lesson, and uses them all correctly.	Uses two vocabulary words (or a form of the vocabulary words) from the lesson, and uses them both correctly.	Uses one vocabulary word (or a form of the vocabulary word) from the lesson, and uses it correctly.	Does not use any vocabulary words, or uses vocabulary words incorrectly.

Final Assignment Rubric (page 2 of 2)
Graphing Distance and Time: Travel

3. Sue predicted that it would take 5 hours to travel 250 miles by car. She made a graph of her actual trip (refer to the graph in the final assignment document).

   Explain how Sue's predicted and actual trips were different. In your response, make sure to discuss how the steepness of different parts of the trip helps you understand what is happening at different moments on the trip.

4	3	2	1
Provides a clear and accurate response to the question. Ideas are elaborated, with three or more relevant supporting details from the reading passage, video, and other materials in the lesson.	Provides an adequate response to the question. Topic and ideas are generally well organized, with two relevant supporting details from the reading passage, video, and other materials in the lesson.	Provides a generally accurate response, with one supporting detail from the reading passage, video, and other materials in the lesson.	Provides an inaccurate response to the question or fails to address the question. May include misinterpretations. Understanding of the topic is not apparent.
Uses at least three vocabulary words (or a form of the vocabulary words) from the lesson, and uses them all correctly.	Uses two vocabulary words (or a form of the vocabulary words) from the lesson, and uses them both correctly.	Uses one vocabulary word (or a form of the vocabulary word) from the lesson, and uses it correctly.	Does not use any vocabulary words, or uses vocabulary words incorrectly.

Scoring the Rubric

Here are two suggestions for scoring the final assignment rubric. Select the option that best meets your needs or develop your own grading system.

Option 1: This option provides one score for each submitted assignment.

Assign a score of 4 or below for the written response (first row of the rubric) and a score of 4 or below for the use of vocabulary (second row of the rubric), for a total maximum score of 8. The interpretation of scores is as follows:

Score	Grade	Narrative Interpretation
7-8	A	Excellent
5-6	B	Good
4	C	Adequate (Fair)
3 or below	D	Minimal

Option 2: This option provides two scores for each submitted assignment: one for written content and one for the use of key vocabulary. An advantage of separate scores is that you can weight students' comprehension and composition differently than you do their knowledge of vocabulary. It can also help you identify specific needs for future instruction.

Assign a score of 4 or below for the written response (first row of the rubric) and a score of 4 or below for the use of vocabulary (second row of the rubric) and then score them separately. The interpretation of scores is as follows:

Score	Grade	Narrative Interpretation
4	A	Excellent
3	B	Good
2	C	Adequate (Fair)
1	D	Minimal

The final grade may look like this: A/B (A for content and B for vocabulary use).